

Science Toolkit: Grade 4 Objective 3.C.1.a

Standard 3.0 Life Science

Topic C. Genetics

Indicator 1. Explain that in order for offspring to resemble their parents, there must be a reliable way to transfer information from one generation to the next.

Objective a. Describe traits found in animals and plants, such as eye color, height, leaf shape, seed type that are passed from one generation to another

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Introduction

Science Grade 4 Standard 3

In the study of Life Science, students use the skills and processes of science to investigate the numbers and diversity of living things that now occupy or once occupied the Earth's surface, the interdependence among living things and the interactions of living things with their environment. Working as scientists do to understand and appreciate diversity, students look for patterns of similarities and differences that permeate the living world. After finding and using these patterns, students study a number of topics to determine how scientists have connected the multitude of individual organisms to theories of genetics (cells, heredity), ecology (flow of matter and energy), and evolution.

Students in the early and intermediate grades have multiple experiences observing and describing the external features of many organisms within a variety of environments, developing schemes for classifying these organisms and establishing that for any particular environment living organisms survive well, less well or not at all. In the middle grades, students move from their invented classification schemes to those created by biologists for describing the vast diversity of organisms, suggesting relationships among them, and generating research questions. They begin to shift their attention from external features to internal structures and functions as a source for determining relatedness of living things.

As the basic units of life, cells have needs and functions that are very similar to those of whole organisms. Students in early grades focus on the basic needs of all living things and identify how different organisms meet these needs. In the intermediate grades, students examine the structure and consider the function of single celled organisms, some organisms that are made of collections of cells, and the different types of cells that make up multi-cellular organisms. In middle school, students develop an understanding that the basic functions of organisms are carried out in cells. They recognize that different kinds of cells make up multicellular organisms that sometimes, in complex systems, these differentiated cells are organized into tissues and organs and that communication between cells in the same or different organs is essential to the living system.

The development of the genetics strand begins with building an observational base for heredity. In the early grades students make observations to see how offspring of familiar animals and plants compare to one another and to their parents. Children's idea that animals reproduce their own kind should be strengthened by a large number of examples, both animal and plant. In intermediate grades, students move from describing individuals (s/he has blue eyes) to naming traits (eye color: blue) and classifying organisms with respect to those traits. Students begin building the notion that within a population whose members are alike in many ways, there is also some variation. In the middle grades students study the transfer of genetic traits—what offspring get from their parents and the mechanism that makes passing information from one generation to another possible. The mechanism for transfer of genetic information logically connects with the study of cells.

Three strands of indicators and objectives contribute to literacy in understanding the flow of matter and energy through ecosystems—the food web (what feeds on what), the cycle of matter which includes decomposition of organisms after death, and the synthesis of food in plants. Students at the intermediate level build on early learning concepts that all living things need food to live and further develop the idea that some source of energy is needed for all organisms to stay alive and grow. In the middle grades, attention is drawn to following matter and energy through ecosystems. Students learn that there are essential differences between how animals and plants obtain food, that food is a source of both

materials and energy for organisms and that both matter and energy are repeatedly transformed and transferred within living systems and the environment.

The evolution strand has students in early and intermediate grades revisiting their ideas about biological diversity in living things and fossil remains and their ideas about the consequences of different features of organisms for their survival and reproduction. In middle grades, several lines of evidence are developed. The geographic fossil evidence is expanded into the concept of an evolutionary history. The mechanism for evolution (natural selection) is examined by considering evidence of variation among individuals in a population and changes in environments as determinants in the survival of some species over others.